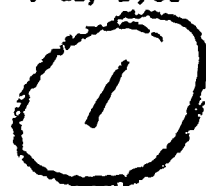


January 11, 1961

## FINAL REPORT

### PHYSIOLOGICAL EFFECTS OF HEATING THE SKIN WITH MICROWAVE AND INFRARED RADIATION



Prepared by: James D. Hardy

NR-114-257

CONTRACT No.: N-onr-551 (12)

CONTRACTOR: University of Pennsylvania, Philadelphia, Penna.

PRINCIPAL INVESTIGATOR: James D. Hardy

Assistants: O. Bailey, F. B. Benjamin, C. C. Clark, D. Cunningham,  
L. C. Greene, H. T. Hammel, E. Hendler, M. Lipkin,  
R. Margarida, D. Murgatroyd, D. Scott, A. M. Stoll,  
R. Vinegar, and L. Zitowitz.

**OBJECTIVE:** The objective of this study has been to throw more light on the basic physiology and physiological pathology of heating the skin by means of radiant energy.

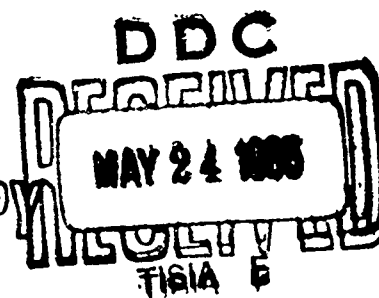
#### BRIEF SUMMARY OF RESULTS:

Initially, it was necessary to conduct basic research to elucidate the optical and thermal properties of human and animal skin. Spectrophotometric measurements were made in the spectral region from 0.4 to 20  $\mu$  for white, pigmented human skin and for animal skin. Thermal measurements were also necessary to determine the thermal diffusivity and thermal inertia of the skin. These studies were followed by the analysis of the effects of radiation to producing pain sensation, temperature sensation and thermal burns. From theoretical considerations, it was deduced that the temperature of the burn area following infliction on the burn was important as regards to pain, healing time and burn development. It would appear that these results have practical application in the problem of man's treatment of burns as well as in the hospital treatment of mild burns. Studies have also been carried out in respect to the heating of the skin by 3 cm and 10 cm microwave radiation. These results appear to have practical application in the problem of radiation safety to Navy personnel operating radar equipment.

Detailed descriptions of the experiments carried out under this contract and the analysis of the results is contained in the following progress reports and scientific publications:

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**a. Progress Reports:**

1. January 13, 1954 - covering period 10-1-53 to 12-31-53
2. January 1, 1955 - " " 1-1-54 to 12-31-54
3. February 1, 1955 - " " 1-1-55 to 12-31-55
4. February 1, 1957 - " " 1-1-56 to 12-31-56
5. November 15, 1957 - " " 1-1-57 to 11- -57
6. November 11, 1958 - " " 11-15-57 to 11-14-58
7. July 28, 1960 - " " 1-5-59 to 1-5-60

**b. Index of Technical Reports and Publications:**

1. Benjamin, F. B.: Effect of histamine depletion on cutaneous pain threshold in man. Fed. Proc., 13:11, 1954.
2. Benjamin, F. B.: Effect of histamine releaser 48-80 on the inflammatory response in man. J. Applied Physiology, 7:151-153, 1954.
3. Benjamin, F. B.: Allergic contact dermatitis due to histamine releaser drug 48-80. Arch. Derm., 70:190-191, 1955.
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5. Benjamin, F. B.: Effect of pain on simultaneous perception of non-painful sensory stimulation. Journal of Applied Physiology, 8:30-34, 1956.
6. Benjamin, F. B. and C. Bailey: The effect of skin texture on the heating of the human skin by thermal radiation. J. Invest. Dermat., 26:472-477, 1956.
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9. Clark, C. C., R. Vinegar and J. D. Hardy: Goniometric spectrometer for the measurement of diffuse reflectance and transmittance of skin in the infrared spectral region. Journal of Optical Soc. of America. Vol. 43, #11, 1953..
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